

**General Certificate of Secondary  
Education**

**Design and Technology:**

**Innovator Suite**

**Industrial Technology**

Unit A544: Technical aspects of  
designing and making

**Specimen Paper**

## A544

Time: 1 hour 15 minutes

Candidates answer on question paper:  
**Additional Materials:**



Candidate  
Forename

Candidate  
Surname

Centre  
Number

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Candidate  
Number

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### INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- You have 2 minutes to read through this question paper.
- Answer **all** the questions.
- You may answer the parts of each question in any order you wish, **writing legibly** with a pencil or pen
- Do not write in the bar codes.
- Do not write outside the box bordering each page.
- Write your answer to each question in the space provided.

### INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.

#### FOR EXAMINER'S USE

1	
2	
3	
4	
5	
TOTAL	

This document consists of **10** printed pages and **2** blank pages.

**[Turn over**

### Section A

Answer **all** questions.

- 1 Fig. 1 shows a fixing plate made in the school workshop from 50 x 3 BDMS.

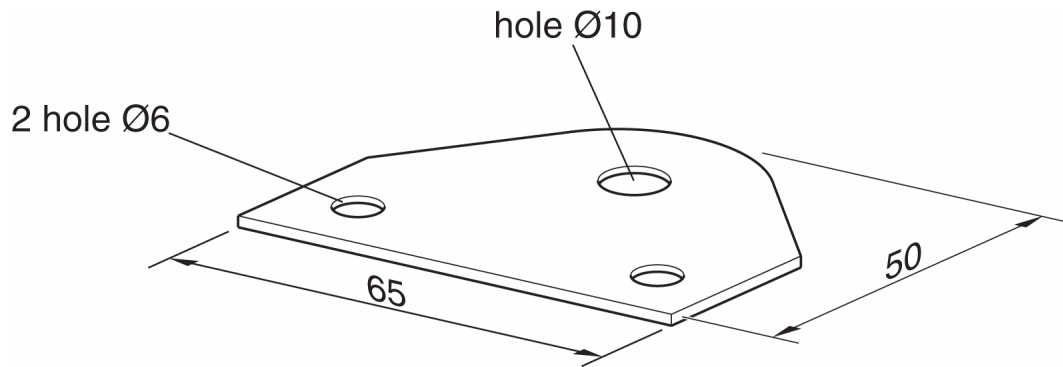




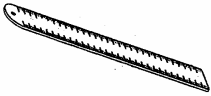
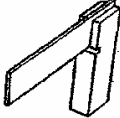
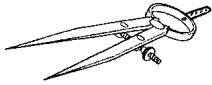
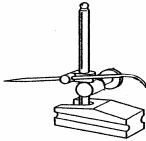
Fig. 1

- (a) State what the letters BDMS stand for.

B ..... D ..... M ..... S .....

[1]

- (b) Complete the table below by adding the correct name for each of the marking out tools shown. The first one has been done for you.

Tool	Name	Tool	Name
	Odd legged calipers		
			
			

[5]

- (c) (i) Name **three** cutting tools you would use in the school workshop to make the fixing plate shown in Fig. 1.

1. .... [1]

2. .... [1]

3. .... [1]

- (ii) Give **one** way of removing the sharp edges from the fixing plate after it has been made.

.....

..... [1]

(d) Name **two** industrial processes that could be used to produce the fixing plate in large quantities.

1. .... [1]

2. .... [1]

[Total: 12]

2 Fig. 2 shows a display stand made from 2mm sheet brass.

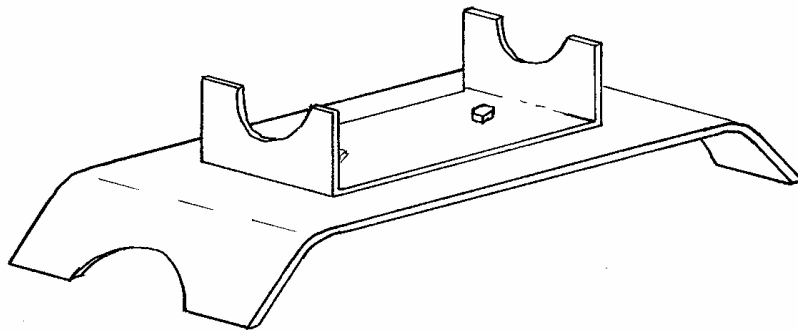


Fig. 2

(a) Brass is described as a non-ferrous alloy.

(i) Explain what is meant by the term “non-ferrous alloy”.

.....  
 .....  
 .....  
 ..... [2]

(ii) Name and describe the workshop process used to soften the brass before bending the two parts of the display stand into shape.

Name of process ..... [1]

Description .....

..... [2]

(b) The two parts of the display stand are fixed together using nuts and bolts.

(i) Give **three** pieces of information needed when buying nuts and bolts.

1. .... [1]

2. .... [1]

3. .... [1]

(ii) Name **one** method of preventing nuts from coming loose.

..... [1]

(c) The use of nuts and bolts is a **temporary** fixing method.

Name **three** methods of **permanently** fixing the two parts of the display stand together.

1. .... [1]

2. .... [1]

3. .... [1]

[Total: 12]

3 Fig. 3 shows a belt pulley from the drive mechanism of a model car.

The pulley is to be made on a centre lathe from Ø20 aluminium alloy bar.

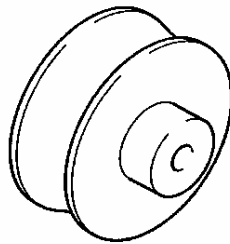
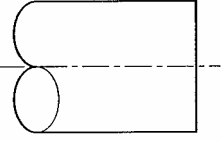
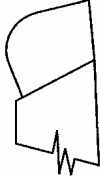
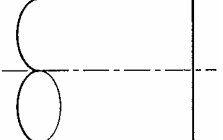
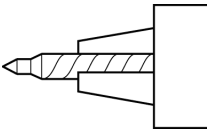
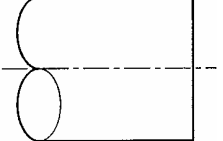
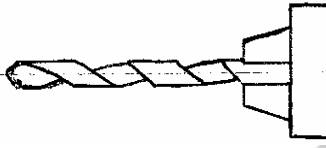
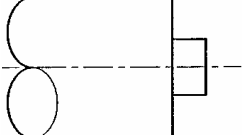
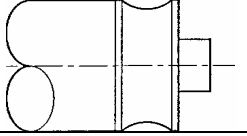
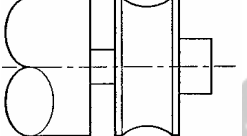


Fig. 3

(a) Give **one** reason why aluminium alloy is a suitable metal for making the pulley.

..... [1]

- (b) Complete the table below to show the sequence of operations for making the pulley on the centre lathe.

Stage	Tool Shape	Process
		Facing - off
		
		Drilling Ø4 hole
		
		Turning profile of pulley
		

[6]

- (c) Describe how the Ø4 hole in the pulley can be produced so that it is smooth and accurately sized.

.....

..... [2]

- (d) It is decided to mass produce the pulleys in plastic rather than aluminium alloy.

The pulleys could be produced by injection moulding or by turning on a CNC lathe.

- (i) Name a specific thermoplastic that would be suitable for making the pulleys.

..... [1]

- (ii) Explain why injection moulding would be more suitable than CNC turning for mass producing the plastic pulleys.

.....

.....

..... [2]

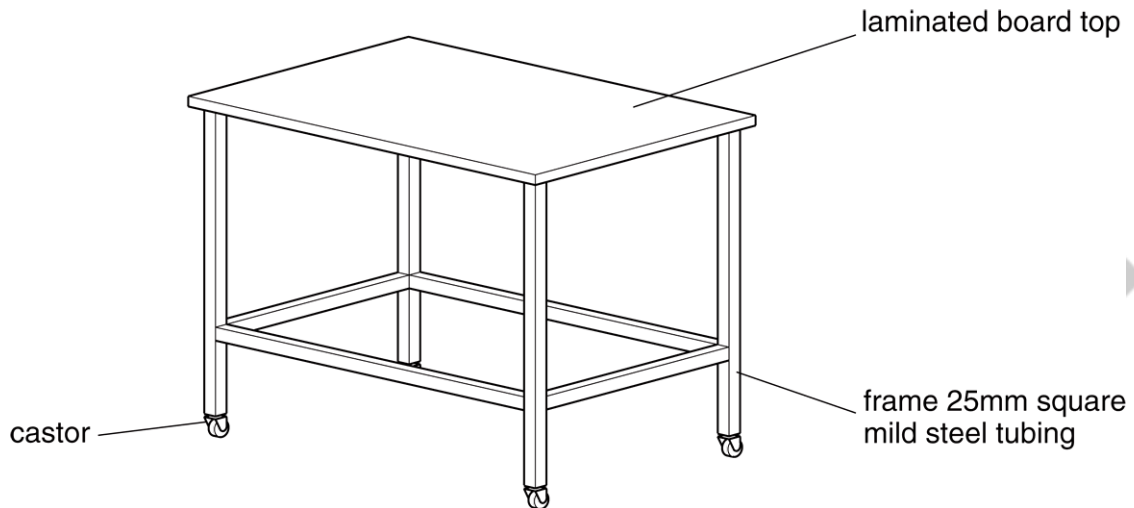
[Total: 12]

SPECIMEN

## Section B

Answer **all** questions

- 4 Fig. 4 shows a projector trolley for use in school classrooms



**Fig.4**

The projector trolley has been designed using CAD.

- (a) Give **two** benefits of using CAD when designing products.

Benefit 1..... [1]

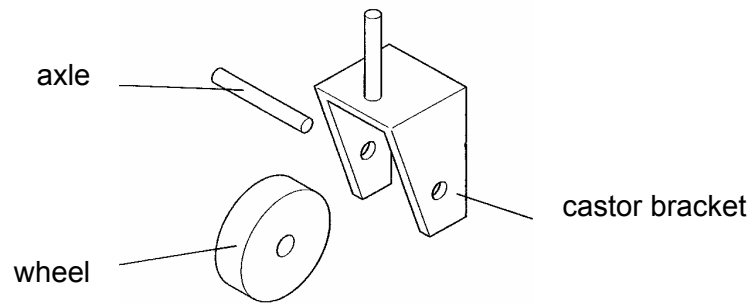
Benefit 2 ..... [1]

- (b) Name **two** suitable processes for joining the parts of the mild steel frame together.

1. .... [1]

2. .... [1]

- (c) Fig. 5 shows the component parts of one of the castors for the trolley. All of the components are made from mild steel.



**Fig. 5**

- (i) Use sketches and notes to show how the castor can be completed so that:
- the wheel runs centrally in the castor bracket and cannot move from side to side;
  - the axle is fixed securely in the castor bracket.
- You may add or modify components in your design.



(ii) Use sketches and notes to show **two** ways of reducing friction between the wheel and the axle.

1.

[2]

2.

[2]

[Total: 12]

5 Fig. 6 shows a novelty storage box designed for young children.

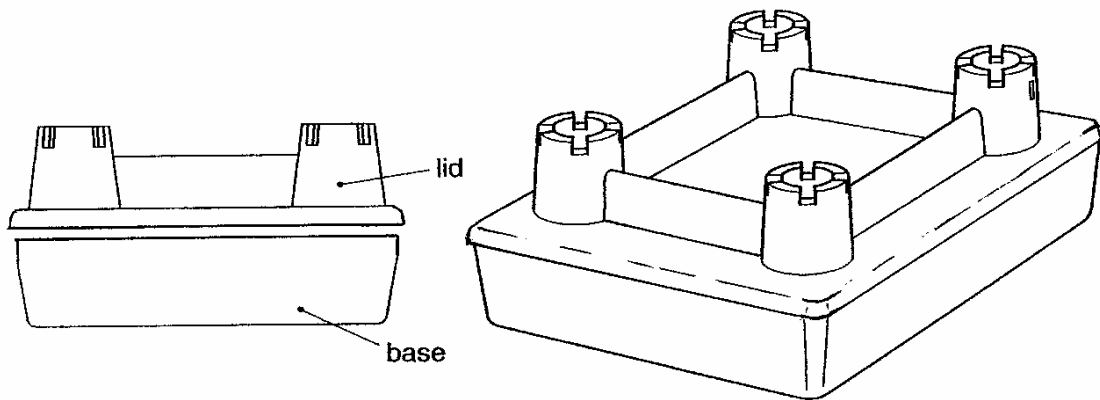


Fig. 6

(a) Both parts of the box are vacuum formed in 3mm thick High Impact Polystyrene (HIPS).

Give **two** reasons why HIPS is a suitable material for the box.

Reason 1 ..... [1]

Reason 2 ..... [1]

- (b) Vacuum Forming and Injection Moulding are two widely used plastics moulding processes.

Name **two** other plastics moulding processes.

1. .... [1]

2. .... [1]

- (c) Use sketches and notes to show the design of the mould needed to successfully vacuum form the **lid** of the box shown in Fig. 6.

[4]

- (d) Using the novelty storage box in Fig. 6 as an example, describe how the principle of “sustainable design” can be applied to everyday products.

.....

.....

.....

.....

.....

..... [4]

[Total: 12]

Paper Total [60]

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The maximum mark for this paper is **60**.

SPECIMEN

Section A											
Question Number	Answer	Max Mark									
1(a)	<p><b>State what the letters BDMS stand for.</b></p> <p>Bright Drawn Mild Steel</p>	[1]									
(b)	<p><b>Complete the table below by adding the correct name for each of the marking out tools shown. The first one has been done for you.</b></p> <table> <tr> <td>xxxxxxx</td><td>Scriber</td><td></td></tr> <tr> <td>(Steel) Rule</td><td>Try Square</td><td></td></tr> <tr> <td>Dividers</td><td>Surface gauge/Scribing block</td><td>(5x1)</td></tr> </table>	xxxxxxx	Scriber		(Steel) Rule	Try Square		Dividers	Surface gauge/Scribing block	(5x1)	[5]
xxxxxxx	Scriber										
(Steel) Rule	Try Square										
Dividers	Surface gauge/Scribing block	(5x1)									
(c)(i)	<p><b>Name three cutting tools you would use in the school workshop to make the fixing plate shown in Fig. 1.</b></p> <p>hacksaw; bench shear; file; drill; laser cutter (1 mark only)</p>	[3]									
(ii)	<p><b>Give one way of removing the sharp edges from the fixing plate after it has been made.</b></p> <p>emery cloth; linisher; smooth file</p>	[1]									
(d)	<p><b>Name two industrial processes that could be used to produce the fixing plate in large quantities.</b></p> <p>presswork/stamping; laser cutting</p>	[2]									
2(a)(i)	<p><b>Explain what is meant by the term “non-ferrous alloy”.</b></p> <p>Explanation to include reference to mixture of metals (1) no iron content (1)</p>	[2]									
(ii)	<p><b>Name and describe the workshop process used to soften the brass before bending the two parts of the display stand into shape.</b></p> <p>Annealing Heat to (dull) red (1); leave to cool(1)</p>	[3]									
(b)(i)	<p><b>Give three pieces of information needed when buying nuts and bolts.</b></p> <p>material; thread; length; head; quantity</p>	[3]									
(ii)	<p><b>Name one method of preventing nuts from coming loose.</b></p> <p>thread sealant/loctite; locking/spring washer; lock nuts; self locking/nyloc nut</p>	[1]									

Question Number	Answer	Max Mark										
(c)	<p><b>Name three methods of permanently fixing the two parts of the display stand together.</b></p> <p>riveting; (soft) soldering; silver/hard soldering; brazing</p> <p>(3x1)</p>	[3]										
3(a)	<p><b>Give one reason why aluminium alloy is a suitable metal for making the pulley.</b></p> <p>lightness; easy to form/machine; corrosion resistant</p>	[1]										
(b)	<p><b>Complete the table below to show the sequence of operations for making the pulley on the centre lathe.</b></p> <table><tr><td>xxxxxxxxxxx</td><td>centre drilling</td></tr><tr><td>xxxxxxxxxxx</td><td>xxxxxxxxxxx</td></tr><tr><td>knife edge/acute angled cutting tool</td><td>turn down (boss) to size</td></tr><tr><td>round nose/forming tool</td><td>xxxxxxxxxxx</td></tr><tr><td>parting tool</td><td>parting off</td></tr></table> <p>(6x1)</p>	xxxxxxxxxxx	centre drilling	xxxxxxxxxxx	xxxxxxxxxxx	knife edge/acute angled cutting tool	turn down (boss) to size	round nose/forming tool	xxxxxxxxxxx	parting tool	parting off	[6]
xxxxxxxxxxx	centre drilling											
xxxxxxxxxxx	xxxxxxxxxxx											
knife edge/acute angled cutting tool	turn down (boss) to size											
round nose/forming tool	xxxxxxxxxxx											
parting tool	parting off											
(c)	<p><b>Describe how the Ø4 hole in the pulley can be produced so that it is smooth and accurately sized.</b></p> <p>Description to include drilling undersize (1) and use of reamer (1)</p>	[2]										
(d)(i)	<p><b>Name a specific thermoplastic that would be suitable for making the pulleys.</b></p> <p>Suitable thermoplastic e.g. Nylon; HIPS; PVC</p>	[1]										
(ii)	<p><b>Explain why injection moulding would be more suitable than CNC turning for mass producing the plastic pulleys.</b></p> <p>Explanation to include reference to material wastage from machining; higher level of production; multi-impression moulds; faster and therefore cheaper to produce;</p>	[2]										

Section B		
Question Number	Answer	Max Mark
4(a)	<p><b>Give two benefits of using CAD when designing products.</b></p> <p>ability to make changes easily; ability to save and share drawings;            animation/2D modeling; potential to apply to CAM/3D modeling;            can be done anywhere (laptop/PDA) (2x1)</p>	[2]
(b)	<p><b>Name two suitable processes for joining the parts of the mild steel frame together.</b></p> <p>Brazing/Hard Soldering            Welding (2x1)</p>	[2]
(c)(i)	<p><b>Use sketches and notes to show how the castor can be completed so that:</b></p> <ul style="list-style-type: none"> <li>the wheel runs centrally in the castor bracket and cannot move from side to side;</li> <li>the axle is fixed securely in the castor bracket.</li> </ul> <p><b>You may add or modify components in your design.</b></p> <p>spacers/sleeves/bushes; washers and pins/circlips;            suitable annotation (1+1)            threads, nuts and washers; circlips/split pins;            suitable annotation (1+1)</p>	[4]
(ii)	<p><b>Use sketches and notes to show two ways of reducing friction between the wheel and the axle.</b></p> <p>annotated sketch (1) to show ball/roller bearing (1)</p> <p>annotated sketch (1) to show plain bearing/bush with means of lubrication(1)</p> <p>annotated sketch (1) to show nylon bush or wheel (1)</p> <p>annotated sketch (1) to show use of self-lubricating bearing (1) (2x2)</p>	[4]



Question Number	Answer	Max Mark
5(a)	<p><b>Give two reasons why HIPS is a suitable material for the box.</b></p> <p>impact resistant therefore safe in use;  self colour/no paint needed therefore safe in use;  thermoplastic therefore easy to mould into complex shapes; (2x1)</p>	[2]
(b)	<p><b>Name two other plastics moulding processes.</b></p> <p>blow moulding; extrusion; compression moulding; rotational moulding; (2x1)</p>	[2]
(c)	<p><b>Use sketches and notes to show the design of the mould needed to successfully vacuum form the lid of the box shown in Fig. 6.</b></p> <p>clearly annotated sketch (1) to show complete shape (including lower section of lid) (1); draft angles (1); curved corners (1); suction holes (1) (any 4x1)</p>	[4]
(d)	<p><b>Using the novelty storage box in Fig. 6 as an example, describe how the principle of “sustainable design” can be applied to everyday products.</b></p> <p>Description to include reference to reduction in material used; use of recycled/recyclable materials; design and make “to last” (quality); use of energy efficient processes; reduction in finishing processes/materials</p>	[4]
<b>Paper Total</b>		<b>[60]</b>

## Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)	1			1
1(b)	5			5
1(c)(i)	3			3
1(c)(ii)	1			1
1(d)	2			2
2(a)(i)	2			2
2(a)(ii)	3			3
2(b)(i)	3			3
2(b)(ii)	1			1
2(c)	3			3
3(a)			1	1
3(b)	6			6
3(c)	2			2
3(d)(i)	1			1
3(d)(ii)			2	2
4(a)			2	2
4(b)	2			2
4(c)(i)	4			4
4(c)(ii)	4			4
5(a)	2			2
5(b)	2			2
5(c)			4	4
5(d)	4			4
Totals	51		9	60